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ECONOMIC EVALUATION OF SAFETY IMPROVEMENTS IN AVIATION

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Summary: This article analyses safety of commercial air transport and its economic impact. It gives description of organizations which are improving safety and analysing actual statistics of accident rate in Europe and in the world. This topic describes how air accident can influence the popularity and economy conditions of airlines. At the end, based on the learnt knowledge, it suggests the optimal amount of finances that need to be invested in safety of commercial air transport.

Key words: commercial air transport, statistics of accident rate, European Aviation Safety Agency, safety, air accident costs, safety costs

INTRODUCTION

Air transport is one of the safest forms of travel. It has reached intensive development of safety components using learnt knowledge from another kind of industry, not only sponsored by financial funds but by the biggest price – the price of human life. Each victim of air accident helps to improve safety and prevent creating of similar situations. All these factors contributed to current state that nowadays there is normal to board aircraft and safely travel to anyplace in the world in just a few hours. Many worlds' experts put all their effort into reaching this standard of safety. This endeavour was realized with support of governments and aviation institutions. (1)

Financial supports, which cover costs to prevent this situations, is increasing every year while the actual trend of number of accidents and victims keeps on lower level (in commercial air transport).

This article summarizes actual condition of commercial air transport in the field of accidents and its economic conditions. In this article we focus on European commercial air transport and its fatal accidents in member states of European Aviation Safety Agency in comparison with worldwide statistics. We make analysis of specific air accidents and its economic impact to the airline and try to find a connection between budget of safety organizations and expenses in case of air accidents. Finally, we try to suggest optimal amount of financial funds to prevent air accidents.

1. SAFETY

The goal of safety in aviation is to explore negative influences and to prevent from them. It is related to air accident investigation and learning from the findings. It was

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necessary to create rules which provide required quality of air transport. These rules are created and upgraded by many experts who are grouped together by specialization and location. All procedures and activities were created with a single goal to get commercial air transport to the required level of safety and sustainability of its development. (2)

1.1 Organisations

During the last century many governmental and non-governmental institutions were created to increase safety and reliability of air traffic. Their activities includes not only aircraft but also other activities connected to aviation, such as development and research of constructions and materials, certification of aircraft and crew, regulation and legislation, maintenance, construction of airports and protection systems. Most important institutions are listed below:

- ICAO – The International Civil Aviation Organization
- ECAC – The European Civil Aviation Conference
- EASA – The European Aviation Safety Agency
- EUROCONTROL – The European organization for the safety of air navigation

1.2 Specifications of European commercial air transport

Intensity of air transport has been increasing, but air accidents have been happening despite of aviation experts' effort. Aviation organizations are more complex than 10 years ago. Nowadays there are different procedures in investigation, collecting, selecting, and analysing of data from member states of the European Union. Investigation of air accidents is based on new sources of technical knowledge.

An older legislation frame was based on the ICAO and its Convention on International Civil Aviation and its Annex 13. ICAO has published manuals and guidance material to advise States on the conduct of aviation accident investigations.

The member States of the European Union closely co-operate and provide a mutual assistance in the field of air accidents and accident investigations. Recognizing the importance of aviation accident investigation, in 1980 the European Union adopted Directive 80/1266/EEC. This Directive was the first piece of air safety legislation adopted by the Union. It was later replaced by Council Directive 94/56/EC. Because of changing of European Aviation and its structure, the new framework was needed by many reasons:

- Substantial growth of the EU common aviation market
- Increasing complexity of the air transport sector
- Varying capabilities of Accidents Investigation Boards compared to 1994

Directive 2003/42/EC has published reports of individual experts, where were mentioned all gaps in framework which caused accidents. This Directive created a software tool and a European database, which are being used for studies and analysis. The directive takes in consideration changes in frame of institutional and regulatory framework which was created by the Directive 64/56/EC and establishing of the EASA. The directive appoints the EASA to be involved in an air accident investigation. The EASA is performing in the name of

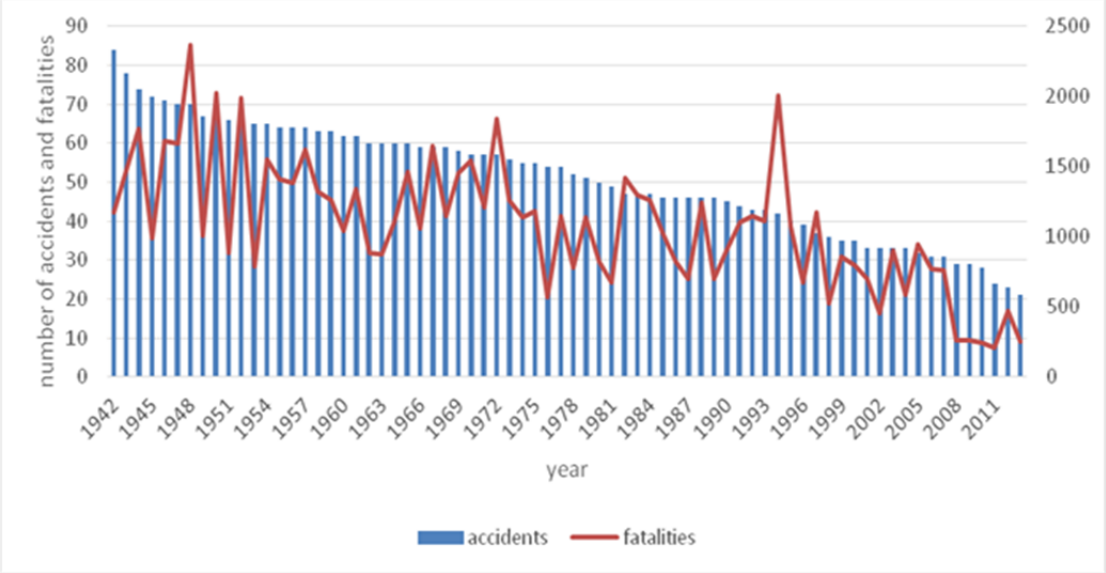
member states, their functions and duties. Everything mentioned is in agreement of Chicago Convention, annex 13.

2. EXPENSES IN CASE OF AIR ACCIDENTS AND THEIR IMPACT ON ECONOMICAL CONDITIONS OF AIRLINE

2.1 Statistics

Figure 1 show accident rates for accidents involving passenger fatalities for scheduled commercial transport operations from 1942 to 2013. During this period the ratio falls down to a quarter value. Every year the line is continually degreasing from 84 to 21 accidents in commercial air transport in the world. (4)

It can be registered different progress in number of fatalities. Unbalanced trend proves the fact that one fatal accident of large wide body aircraft increases the amount of fatalities to higher level. In the past there were planes with capacity of about 100 seats. Nowadays there are airplanes with capacity of about 500 passengers. These facts cause the situation that in case of one fatal accident more people died than in the past.



Source: (Authors)

Fig. 1 – Number of accidents and fatalities

The statistics in the European Union show the degreasing character as well. Fig. 2 presents the actual situation that number of fatal accidents in member states of the EASA are much lower than fatal accidents of foreign registered aircraft. It is proved by the average accidents in last 12 years. In member states the rate is 3.6 accidents per year and in third party states this ratio is about 45.5 accidents per year. Both lines have a similar decreasing character with the lowest value in 2012.

The first breakdown was in 2004, when only one fatal accident happened. The most optimistic year was 2010, when no accident happened in commercial air transport and there was no fatality of passengers, crew or other people. These facts are shown in fig. 2.

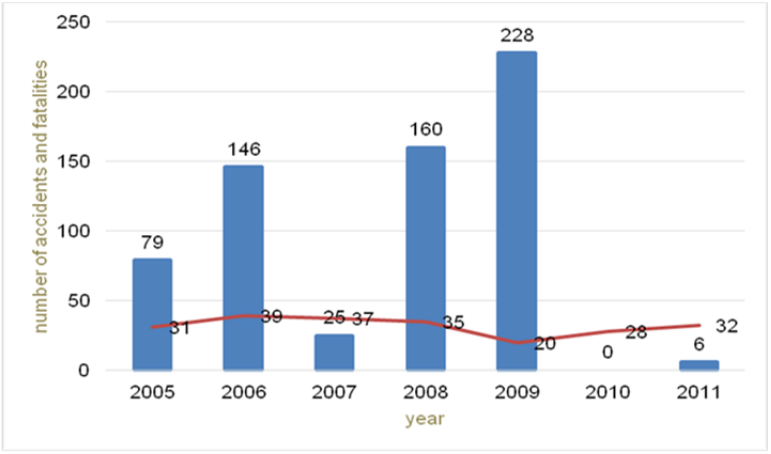
Source: (Authors)

Fig. 2 – Number of fatal accidents

The EASA has been publishing Annual Safety Review every year in which can be found statistics of number of fatal accidents and fatalities in member and non-member states of this organization. From 2005 to 2011 the number of fatal accidents is in range of 20 and 39 accidents, it means average 31.7 accidents a year. (4) In this period this number is stable and there is no evidence of strong divergence. But the number of fatalities is rapidly changed because of size of fatal accident. How we can see in fig. 3. In this period can be registered three bigger accidents of airliners:

- S7 Airlines in 2006,
- Spanair in 2008,
- Air France in 2009.

In last mentioned case it is single accident where all people (inc. passengers and crew) died.



Source: (Authors)

Fig. 3 – Number of accidents and fatalities in EASA member states

2.2 Analysis of air accidents

A fatal accident causes big economic impact on an airline. It is not only financial problems connected with airline, such as compensations of fatalities, write-off the aircraft in case of destruction, repair of the aircraft in case of damage, but we have to take into consideration another circumstances which contribute to general perception of aviation. There are:

- safety of aviation, its attractiveness and general perception of air transport,
- confidence in airline,
- value of airline (5),
- economic stability,
- a good name of the company in the market of strong competition.

An air accident is connected with many institutions, sometimes with political, religious or cultural opinions. It could be also big problem for airplane manufacturers. Sometimes it is impulse to improve their products and improve safety of their aircraft. On the other hand, in case of construction failure, the manufacturer admits imperfection of their products and is responsible to make a revision and repair all similar types.

Air accident makes a lot of difficulties also for insurance companies. Not only covering the compensations of fatalities but also covering the airplane cost.

According to all these facts the air accident is one of worst accidents in transport. (6)

This chapter is about specific accident and its economic impact to an airline. We summarize basic economic factors and their change after an accident. The focus is on European commercial air transport, which means the member states of the EASA.

Many airlines had not been so stable to solve financial impact caused by an accident and went bankrupt. There is a list of accident with a small description.

1. Accident of S7 Airlines (7)

It happened at Irkutsk Airport when the pilots didn't properly manage landing and they crashed. Airbus A310 begun to burn and 125 people died on-board. This accident had not caused a big impact on an economical condition of this airline because of the specific Russian air transport and a support of Russian government. (8) This airline had rapidly increasing amount of carried passengers and revenues. In the year of the accident they increased amount of carried passengers by 4 percent which resulted in 7 percent increase of revenues. Only degreasing value of the companies' shares in Moscow stock by 33 percent could be registered.

2. Accident of Atlantic Airways (9)

This accident happened in Norway at Stord Airport. The technical failure of spoilers caused 4 dead people on-board. BAe 146-200 ran out of the runway during landing. In 2007 the airline bought 2 new airplanes but the expected increase of revenues and carried passengers did not come. This accident caused bad economic situation and the airline lost many customers. Based on the difference between the expected and actual sales of their tickets we estimate that their loss was 837,487 EUR.

3. Accident of Régional Compagnie Aérienne Européenne (10)

The pilots of Fokker 100 did a rejected take off because of a bird strike. But this manoeuvre was not successful and the aircraft fall down to the ground after 500 meters in the air. During the short flight the aircraft undercarriage stroke a truck and the driver died. All people on-board survived. This company was owned by Air France so we took data from Air France annual reports. This accident caused a huge decrease of revenues (about 588 million EUR) and reduction of shares (about 2.6 million EUR).

4. Accident of Spanair (11)

This accident happened in Madrid. During take-off the MD-82 crashed to the right of the runway due to improper take-off configuration and 148 people died. The crash amplified financial difficulties at Spanair, which ceased operations in 2012. Thanks to the accident, the airline lost in revenues 1.029 billion EUR early after accident and the value in stock drop down (numerically by 243.18 million EUR).

5. Accident of Air France (12)

The flight AF447 from Sao Paulo to Paris crashed into the Atlantic Ocean. All 228 people on-board died. Because of non-consisted data the autopilot had switched off and the flight crew badly evaluated the situation and let the aircraft fall down. This accident was hugely publicized and caused strong economic difficulties to Air France. The loss of shares in stock dropped down rapidly (about 33.457 million EUR). The loss 14.2 percent of revenues represented 2.981 billion EUR. Most of people were not satisfied with safety of Air France, so they preferred another airline. The loss of passengers was 5 percent.

6. Accident of TAP Air Portugal (13)

This accident happened on the ground during technical handling. We present this accident as an example how it is important for airline to present itself in the eyes of stockholders. It was not a fault of the airline but after this accident the shares declined.

The compensation for fatalities was settled in the Warsaw convention in 1929. The airline's responsibility for one fatality was 8,300 USD. The Hague Protocol doubled this limit to around 16,600 USD. In 1999 The Montreal Convention adopted the use of SDR (Special Drawing Rights) to compensate the victims. The lower limit is 100,000 SDR. (14) In table 1 is SDR conversion rate on day when accident happened.

Tab. 1 – Compensation

Date	Airline	Fatalities	1 SDR (EUR)	Compensation for 1 person (EUR)	Compensation Summary (EUR)
9. 7. 2006	S7 airlines	126	1,16	116 358,63	14 661 186,95
10. 10. 2006	Atlantic Airways	4	1,17	117 148,69	468 594,78
25. 1. 2007	RCAE	1	1,15	115 188,00	115 188,00
20. 8. 2008	Spanair	154	1,07	106 557,00	16 409 778,00
1. 6. 2009	Air France	228	1,10	109 537,00	24 974 436,00
11. 11. 2012	TAP Air Portugal	1	1,13	113 106,00	113 106,00

Source: (Authors)

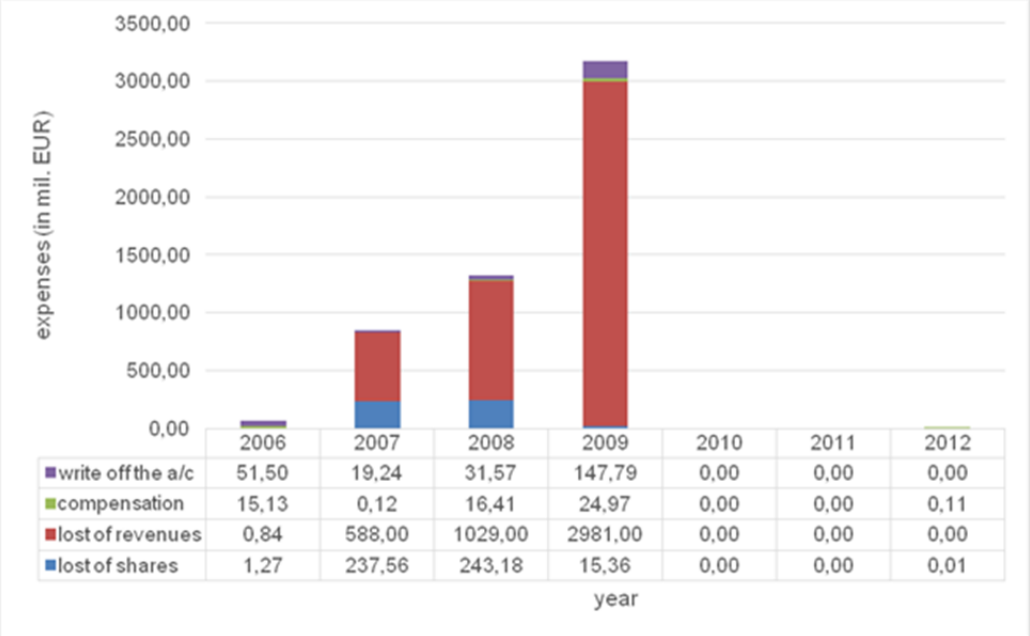
In case of accident we have to make a consideration for damage of the aircraft. In our research we counted with purchasing price of a new aircraft. (15) This calculation is in table 2.

Tab. 2 – Aircrafts price

Airline	Year	Type of aircraft	Conversion rate		Price (in mil. EUR)
			Average price	1	
S7 Airlines	2006	A310-324	$47,50	0,79 EUR	37,39
Atlantic Airways	2006	BAe 146-200a	£9,50	1,48 EUR	14,11
RCAE	2007	Fokker 100	$25,00	0,77 EUR	19,24
Spanair	2008	MD-82	$45,00	0,70 EUR	31,57
Air France	2009	A330-200	$182,55	0,82 EUR	147,79

Source: (Authors)

Figure 4 summarizes all expenses which airlines must settle up after an accidents, divided to 4 categories. The biggest item is the drop of sales. The loss of sales represents up to 90 percent of all expenses, depending on size of the airline.

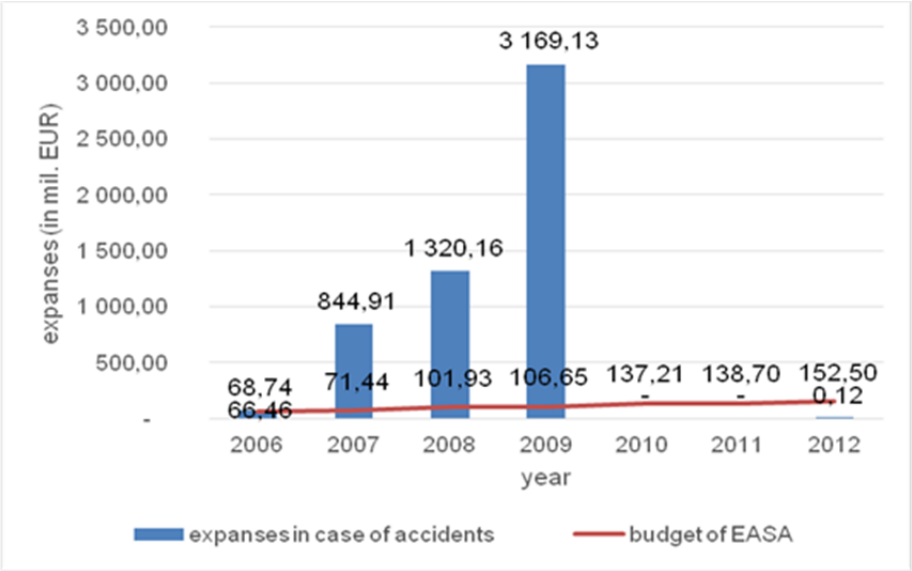


Source: (Authors)

Fig. 4 – Expenses in case of accidents

3. DRAFT OF OPTIMUM MANAGEMENT

In the figure 5 there are shown expenses in case of air accidents and a budget of the EASA. Enormous expenses in case of air accidents are evident in comparison with the budget of the EASA during 2006 – 2009. The growing budget of the EASA did not prevent from air accidents.

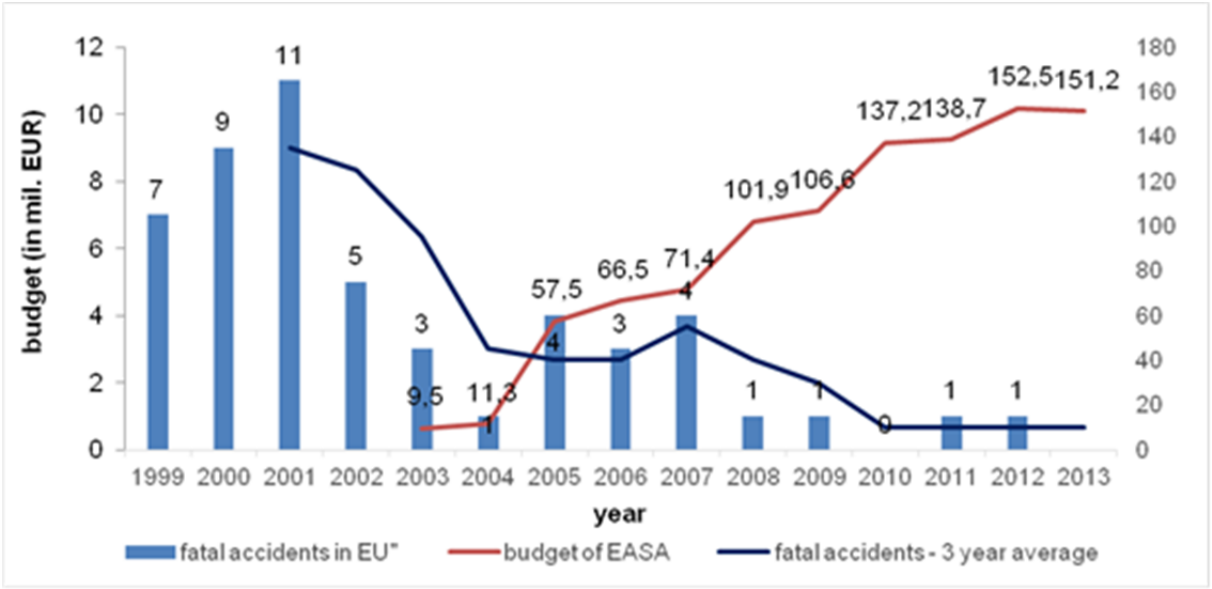


Source: (Authors)

Fig. 5 – Expenses in case of accidents and budget of the EASA

If we divide this chart to two parts, the year 2010 was an important milestone. Air accidents costs exceed the EASA budget between the years 2006 and 2009. No fatal accidents happened between the years 2010 and 2012 and activities of the EASA have saved money of the airlines. Till 2009 fatal accidents have happened while many experts were trying to prevent them. When the budget of the EASA crossed the line of 137.21 million EUR, the budget started to be efficient. From this year the management of the EASA seemed to reach the optimal situation.

The figure 6 proves these results which represent the number of accidents and the budget of the EASA. The situation from the year 2010 has been very optimistic and the number of fatal accidents ended up at a very low level.



Source: (Authors)

Fig. 6 – Number of accidents in EU and budget of the EASA

Costs of EASA have been increasing continually. The second year of its existence the budget grew up by 80 percent against the previous year. In average the EASA have been increasing their budget by 18 percent each year. The first year when the plan of budget was lower was the year 2013.

Number of legislative precautions issued by the EASA between the years 2003 and 2012 varies around 26 each year. This trend remains the same apart from the year 2013 when there were more than 45 published statements and decisions, which is nearly 20 issued precautions more than is the average within the observed period. The budget of the EASA is increasing every year, however the number of issued statements and decisions is stable. Year 2013 was an interesting milestone when the EASA issued so many legislative precautions but their budget plan was lower than previous year. EASA has got more competencies than issuing legislative statements and so this is not the only way they should be looked at and measured.

According to our research and all facts mentioned we can state, that costs of the EASA pay off in the field of increasing safety of air transport and decreasing expenses in case of air accidents.

CONCLUSION

Air accidents heavily influence stability and economic activities of airlines, which must face to a big economical loss. The important factor is publicity of these accidents, which causes the loss of carried passengers, revenues and trustworthiness of shareholders. Depending on size of an airline the loss of carried passengers is about 11 percent which means loss of revenues between 9 percent and 17 percent. The price of shares was reduced by 35 percent. The stock market value of airline was lower between 15 percent and 45 percent after an accident.

We summarized actual situation in the field of air accidents of commercial transport based on statistics, annual reports of airlines and stock market values and intended to find the link between the costs of air safety organizations and the costs in case of an accident. Subsequently we propose an optimal financing of the European Aviation Safety Agency. According to the results of our study, the optimal financing was achieved between 2010 and 2012 when the budget of the EASA was from 137.21 million EUR to 152.5 million EUR.

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